



# Missouri Department of Natural Resources

## **Stream Survey Sampling Report**

### **Phase II Hinkson Creek Stream Study Columbia, Missouri Boone County**

**July 2004-June 2005**

Prepared For:

Missouri Department of Natural Resources  
Division of Environmental Quality  
Water Protection Branch  
Water Pollution Control Program

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## EXECUTIVE SUMMARY

The Missouri Department of Natural Resources, Water Protection Branch, Water Pollution Control Program placed a 14-mile segment of Hinkson Creek on the 1998 list of impaired waters designated under section 303(d) of the federal Clean Water Act for “unspecified pollutants” due to urban runoff. A history of fish kills, the physical alteration of stream channels and adjacent riparian corridors, and other problems associated with urbanization have resulted in the designated beneficial uses becoming impaired. These urbanization concerns include the potential for water quality degradation, increased flow intensity due to stormwater runoff of impervious surfaces, and the likely detrimental effects of development on the stream channel and riparian areas.

Biological monitoring during the fall of 2001 and the spring of 2002 by the Missouri Department of Natural Resources, Field Services Division, Environmental Services Program determined that the biological integrity of Hinkson Creek was impaired for approximately 14.0 miles below the Interstate 70 bridge crossing. Therefore, it was determined that further water quality work was required to confirm the impairment of the aquatic community and attempt to determine the nature and source(s) of the impairment. The Environmental Services Program’s Water Quality Monitoring Section conducted phase I of a study consisting of a combination of biological and chemical monitoring combined with toxicity testing in the upper portion of the impaired segment. Water and sediment samples were collected from main-stem Hinkson Creek and storm drainages located within this portion of Hinkson Creek.

Results of the phase I study documented that the aquatic community was impaired in Hinkson Creek between I-70 and Broadway and that the impairment extended downstream. Toxicity tests documented toxicity in approximately 20% of stormwater discharges and in main-stem Hinkson Creek at Broadway. Toxicity Identification Evaluation procedures implicated a variety of urban-associated chemical constituents including organic chemicals (polycyclic aromatic hydrocarbons, pesticides, petroleum compounds, and metals) in some stormwater discharges and high levels of sodium and calcium chloride in snowmelt samples. Although the presence of chemicals and toxicity of stormwater does not automatically translate to toxicity in-stream, it did suggest possible contaminants and sources that are likely contributors to in-stream effects. In-stream toxicity was documented in Hinkson Creek at the Broadway bridge during the snowmelt sampling. This observation is significant because it ties in-stream effects to a particular runoff event.

*Escherichia coli* (*E. coli*) counts occasionally exceeded recommended levels during phase I and may have resulted from a variety of sources. The presence of this fecal bacterium is particularly significant because as urbanization continues in the Hinkson Creek watershed human recreational contact with the stream will likely increase.

A visual sediment survey documented increased sediment in the impaired segment of Hinkson Creek compared to upstream estimates. Observations of land disturbance and erosion suggested an explanation for this increase in sedimentation.

Phase II of the Hinkson Stream Study was performed in a similar manner as was phase I. Because the source and type of pollutant(s) were listed as unknown, a water quality triad was used to document impairments to the aquatic community and identify pollutants that are likely contributing to those impairments. The water quality triad is an integrated assessment of information obtained from the aquatic community, chemical analyses, and toxicity testing. The steps in the triad include documenting that impairment to the aquatic community still exists, testing a variety of in-stream, stormwater, and sediment samples for toxicity using a bioluminescent microorganism (*Vibrio fischeri*) and in some cases a freshwater daphnid (*Ceriodaphnia dubia*). The purpose of this was to correlate effects of laboratory test organisms with in-stream effects on the biological community. Toxic samples were further manipulated using Toxicity Identification Evaluation procedures which are standard procedures that allowed us to determine what broad classes of chemical compounds (e.g., metals, organics) might be causing or contributing to the observed toxicity. The final step in the triad was to analyze the toxic samples for the chemical constituents indicated through the Toxicity Identification Evaluation procedures.

The Hinkson Creek phase II findings are summarized below:

- *In-situ* conductivity values were higher in Hinkson Creek during base flow when compared to reference/control streams within the same EDU.
- Turbidity levels were highest at the Highway 63 connector and old Highway 63 sites during base flow events. High turbidity during periods of low or base flow conditions is indicative of in-stream activity such as that which occurs during land disturbance activities.
- Chloride values in Hinkson Creek were approximately 40% higher when compared to reference/control streams within the same EDU during base flow events.
- Toxicity tended to be sporadic. None of the sampled drainages were found consistently toxic. Of the stormwater samples collected, eight (8) samples were toxic to the Microtox organisms. Metals (arsenic, chromium, copper, lead, nickel, zinc), organic constituents (e.g., PAHs), and plasticizers were the main constituents found.
- SPMD analyses indicated the presence of several low-level semi-volatile organic chemicals (e.g., pesticides and/or breakdown products, phthalates, and pharmaceutical drugs) that have the potential to bioaccumulate in aquatic organisms.

- Biological metrics describing the macroinvertebrate community at Station 6 during this study exhibited improvement compared to spring samples collected in 2002 and 2004 and, for the first time among three sample seasons, were sufficient to merit a fully supporting SCI score. Compared to 2002, Taxa Richness increased by 14 taxa and EPT Taxa nearly doubled, increasing by 7.
- The improvement in metric scores and the increasing similarity index between Station 6 and Station 7 could be interpreted as a demonstration that Station 6 is developing better potential to support a diverse macroinvertebrate community. This increased potential at Station 6 may result from a decrease of the quantity and frequency of perturbations that were observed and/or suspected in previous years (e.g., sewer bypasses, petroleum products, insecticides, road salt, and sediment).
- Although Station 6 appears to have improved compared to previous years, the macroinvertebrate community within the urbanized reach nevertheless showed some important differences compared to the upstream reference reach. Most notably, Station 3.5 had a fraction of the number of mayflies and stoneflies compared to each of the other stations. In addition, each of the urbanized reaches had much higher numbers of tubificid worms than Station 7. Tubificids were nearly twice as abundant at Station 3.5 than at the next nearest site. Tubificid worms tend to be tolerant of sediment and also organic pollutants. This might reflect previously documented inputs of sediment and organic loading (e.g., bypasses, etc.).

With the growing amount of impervious surfaces located in the Hinkson Creek watershed, we can suspect that hydrologic changes have and will continue to occur in Hinkson Creek. Other urban stream studies have documented links between development and alterations to the natural landscape. There appears to be a strong correlation between the imperviousness of a drainage basin and the health of its receiving streams (Arnold and Gibbons 1996, US EPA 1993, Stankowski 1972, Schueler 1994). As the percentage of the land covered by impervious surface increases, there is a consistent degradation of water quality. Degradation occurs at relatively low levels of imperviousness (10-20%) and worsens as more areas are paved. The US EPA (1993) also reported that urbanization negatively affects streams and results in water quality problems such as loss of habitat, increased temperatures, sedimentation, and loss of fish populations.

Progressive and innovative land management and land use practices are needed to prevent further degradation of Hinkson Creek and other urban streams located throughout the state of Missouri. Low impact development such as decreasing and slowing stormwater discharges and creating grassy and/or vegetative swales to capture small precipitation events that allow water to percolate through the soil to recharge groundwater systems are methods that can help mitigate detrimental effects of urbanization on streams. Educational efforts focusing on the importance of stormwater management practices are currently being used in the Great Lakes region and in the eastern and western coastal regions and should be increasingly considered in Midwestern communities.